Alnor®

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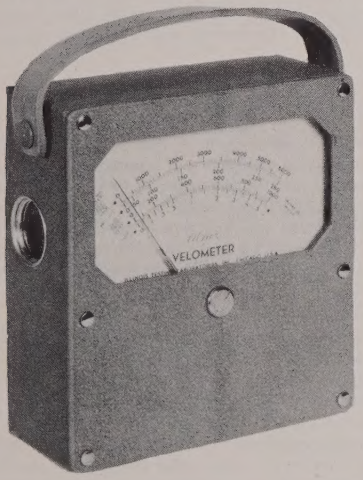
Velometer® Instructions Diffuser Data Section



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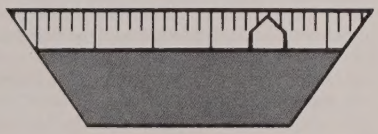

Information on the use of the Velometer on diffusers of several manufacturers. Based on the best available data.

ALNOR INSTRUMENT COMPANY
DIV. OF ILLINOIS TESTING LABORATORIES, INC.
420 N. La Salle Street
Chicago 10, Illinois

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HOW TO BALANCE A KNO-DRAFT EQUIPPED INSTALLATION WITH AN "ALNOR" VELOMETER

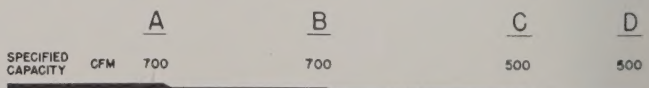
An "Alnor" Velometer equipped with a 2220 Jet makes it possible to balance a Kno-Draft installation quickly. The following instructions and air capacity factors have been prepared by the Connor Engineering Corporation and are reproduced with its permission.

To regulate the air delivery of any KNO-DRAFT Air Diffuser equipped with Type D Air Volume Control, proceed as follows:
Determine the actual air delivery of the diffuser with the Air Volume Damper full open (as explained under Capacity Determination, Page 2). Then throttle the Damper for whatever percentage of such actual air delivery is required. The degree of damper throttling (number of turns of the damper screw) for any percentage of the full open air delivery for any size and type KNO-DRAFT Diffuser will be found by referring to the table and instructions on KNO-DRAFT Air Volume Adjustment, Page 4.

Before balancing an air distribution system employing KNO-DRAFT Air Diffusers with Type D Air Volume Control, i.e., adjusting each diffuser in the system to deliver its specified or desired air capacity, all trunk and branch duct dampers (see Page 2) and all diffuser dampers must be in the full open position. The *actual* air delivery from each diffuser should then be measured by velometer reading (see instructions and capacity factors, Page 2 and 3). This will determine the variation between the actual air delivery and that specified or desired for each diffuser. In each system one diffuser will be under capacity by a *maximum percentage* and the dampers of all *other* diffusers must, therefore, be throttled to obtain the required *relative* air delivery from each diffuser (see example below).

After the diffusers have been balanced in accordance with the given example, a velometer re-check of the diffuser with full open damper (D in example) will indicate whether it delivers the required capacity. If not, it will be known that the air delivery of every diffuser varies from the required delivery *in the same ratio* and will be corrected automatically by adjusting the fan delivery accordingly. On larger systems consisting of numerous branches, it will usually be found most convenient to balance the diffusers on each branch separately in the manner described and then balance the respective branches by adjustment of branch dampers (see Page 2). By following this procedure, it will be found that any KNO-DRAFT-equipped system can be balanced quickly and accurately.

EXAMPLE



COMPUTATION		A	B	C	D	
(c) $\frac{(b) \times 100}{(a)}$	=	114%	108.5%	90%	80%	(lowest)
(d) 80% of (a)	=	560	560	400	400	
(e) $\frac{(d) \times 100}{(b)}$	=	70%	73.7%	89%	100%	(full open)

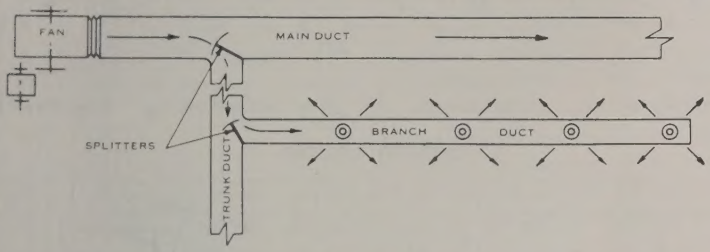
Line (e) indicates percent of full open capacity required for each diffuser and by reference to Table 1, Page 30, the number of damper screw turns for these percentages will be found to be 10¾ for A, 9¾ for B, 3½ for C and, of course, none for D.

TESTING AND BALANCING

GENERAL

the system is one having branch ducts each serv-
g multiple diffusers, an adjustable splitter should
e installed at the junction of each such branch duct
ith the main or trunk duct to provide the facility
divert the correct total volume of air into each
spective branch (see diagram).

When the installation of the ventilating or air conditioning system has been completed and is ready for balancing, all system and individual diffuser dampers should be fully opened and the fan started up. Then proceed as explained in the text above the example on Page 1, making sure that the fan speed remains constant during the balancing operations.



CAPACITY DETERMINATION

ith the proportionate air distribution as outlined
ove established, the air delivery from each dif-
ser can be determined by means of a standard
lometer and the KNO-DRAFT Calibrated Capac-
y Factors as explained below.

he tables on the opposite page contain the factors
r determining the air delivery of any size or type
NO-DRAFT Air Diffuser corresponding to its air
scharge velocity. The air velocity may be read
ith a velometer as shown in Figure 1 below.

t least four readings should be taken for each dif-
ser and averaged. These four readings should be
ken at points a, b, c and d as indicated in Figure
For exterme accuracy, if desired, additional readings may be taken midway between the four recommended points and the eight readings averaged.

In taking each reading, the velometer nozzle must be held (1) in a true vertical position, (2) so that its port is completely exposed to the discharge air stream immediately above the edge of Cone B, (3) so that the port points toward the exact center of the diffuser. The most convenient means of correctly positioning the jet or nozzle is to use Alnor jet number SED 55-29-12. This is an Alnor Type 2220 Jet except that it is equipped with a notched fin. Place the jet so that the lip or edge of the cone fits into this notch.

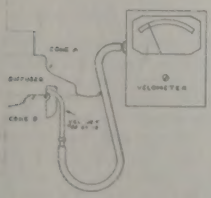
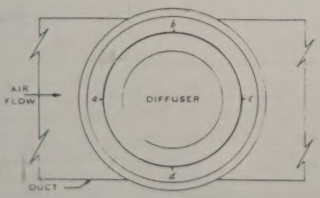


FIGURE 1



PLAN VIEW LOOKING UP

FIGURE 2

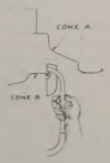


FIGURE 3

AIR CAPACITY FACTORS

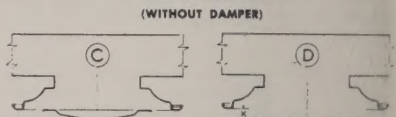
By multiplying the average velometer reading (see opposite page) by the respective factor for the size, type and cone setting of the diffuser, its capacity is obtained (see examples below).

SERIES K DIFFUSERS

TYPE KD and KDA
(WITH FULLY OPEN DAMPER)

B Cone Flush or Raised — B Cone Dropped (X)

TYPE K and KA
(WITHOUT DAMPER)



B Cone Flush or Raised — B Cone Dropped (X)

CAPACITY FACTORS

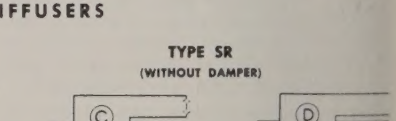
SIZE	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	27	30	36
A	.046	.072	.104	.142	.185	.234	.289	.350	.417	.567	.741	.938	1.16	1.39	1.67	2.11	2.60	3.75
B	.049	.076	.109	.149	.195	.247	.304	.368	.438	.596	.778	.985	1.22	1.46	1.75	2.22	2.74	3.94
C	.051	.080	.115	.158	.204	.258	.319	.386	.460	.625	.817	1.03	1.27	1.53	1.84	2.32	2.87	4.14
D	.059	.092	.133	.181	.237	.300	.370	.448	.533	.725	.947	1.18	1.45	1.76	2.09	2.65	3.28	4.80
X	5/32	3/16	1/4	9/32	11/32	3/8	13/32	15/32	1/2	9/16	11/16	3/4	13/16	15/16	1	1 1/8	1 1/4	1 1/2

SERIES SR DIFFUSERS

TYPE SRD
(WITH FULLY OPEN DAMPER)

B Cone Flush or Raised — B Cone Dropped (X)

TYPE SR
(WITHOUT DAMPER)



B Cone Flush or Raised — B Cone Dropped (X)

CAPACITY FACTORS

SIZE	6	8	10	12	14	16	18	20	24
A	.068	.124	.196	.272	.376	.496	.612	.785	1.09
B	.070	.127	.201	.278	.384	.507	.626	.803	1.11
C	.075	.137	.217	.300	.414	.546	.675	.867	1.20
D	.083	.152	.241	.334	.461	.608	.752	.965	1.34
X	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	3/8

Example (a). The average velometer reading for a 12" Type KD with cones set flush (Diagram A)' is 1750. The factor in the table in line A under 12" is .417, therefore capacity = 1750 × .417 or 730 CFM. (b) The average velometer reading for a 16" Type SR Diffuser with cone B lowered (Diagram D) is 1530. The factor in the table in line D under 16" is .608. Therefore, capacity = 1530 × .608 or 930 CFM. It is important always to use the factor for the particular type and size diffuser being measured *in the line corresponding to the cone setting* when the reading is taken.

AIR VOLUME ADJUSTMENT

TABLE 1

TYPES KD AND KDA

NUMBER OF DAMPER SCREW TURNS (CLOCKWISE) FROM FULL OPEN

PER CENT OF FULL OPEN CAPACITY / SIZE	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	27	30	36
95	¾	1	1¼	1½	1½	1¾	2	2¼	2½	2¾	3¼	3¾	4	4½	5	5½	6	7¼
90	1½	1¾	2¼	2½	3	3¼	3½	4	4½	5¼	5¾	6½	7¼	8	8¾	10	11	13¼
85	2	2½	3	3½	4	4½	5	5½	6	7¼	8¼	9¼	10¼	11¼	12¼	13¾	15¼	18¼
80	2½	3¼	4	4½	5¼	5¾	6½	7	7¾	9¼	10½	11¾	13	14¼	15½	17½	19½	23½
75	3	3¾	4¾	5½	6¼	7	7¾	8½	9¼	10¾	12½	14	15½	17	18½	21	23¼	28
70	3½	4½	5½	6¼	7¼	8	9	10	10¾	12½	14½	16¼	18	19¾	21½	24¼	27	32½
65	4	5	6	7	8	9	10	11	12¼	14½	16¼	18¼	20¼	22¼	24¼	27¼	30¼	36¼
60	4½	5¾	6¾	7¾	9	10	11¼	12¼	13¼	15¾	18	20¼	22½	24¾	27	30¼	33¾	40½
55	5	6¼	7½	8¾	10	11	12¼	13½	14¾	17¼	19¾	22¼	24¾	27¼	29¾	33½	37¼	45½
50	5½	6¾	8	9½	10¾	12	13½	14¾	16¼	19	21½	24¼	27	29¾	32½	36½	40½	48½
45	5¾	7¼	8¾	10¼	11½	13	14½	16	17½	20¼	23¼	26¼	29	32	34¾	39¼	43½	52½
40	6¼	7¾	9¼	10¾	12½	14	15½	17	18½	21¾	24¾	28	31	34¼	37¼	42	46½	56

Screw Turns apply from full open position of Damper.

TABLE 2

TYPE SRD

NO. OF DAMPER SCREW TURNS FROM FULL OPEN

PER CENT OF FULL OPEN CAPACITY / SIZE	6	8	10	12	14	16	18	20	24
95	1½	2	2½	2½	3	3½	4	4½	5
90	2½	3	4	4½	5½	6½	7	8	9
85	3½	4½	6	7	8	9	10	12	13
80	4½	6	7½	8½	10½	11½	13	15	17
75	5½	7½	9	10½	12½	14	15½	18	20½
70	6¼	8½	10½	12½	15	16½	18	21	24
65	7	9½	12	14	17	19	20½	24	27
60	8	11	13½	15½	19	21	23	27	30
55	8¾	12	15	17	20½	23½	25½	30	33
50	9½	13	16½	18½	22½	25½	28	33	36
45	10½	14	17½	20	24½	27½	30	35	40
40	11	15	19	22	26½	29½	32½	38	43

Example:

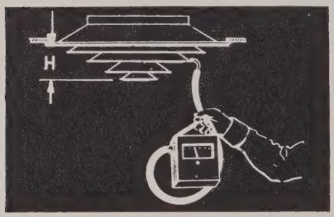
The actual air delivery of a 14 inch Type KD Supply Air Diffuser with full open Damper as determined by velometer reading (see Pages 2 and 3) is 1500 CFM and the capacity desired is 1200 CFM or 80 percent of its actual air delivery. By referring to Table 1 under size 14 and opposite 80% of full open capacity it is found that 9¾ clockwise turns of the central damper screw are required.

The actual air delivery of an 18 inch Type SRD Supply and Return Air Diffuser with full open damper by velometer check is 1200 CFM whereas the capacity required is 1050 CFM or 87½ percent of the actual air delivery. By referring to Table 2 under size 18 and interpolating between 85 percent (10) and 90 percent (7) it is found that the number of clockwise damper screw turns required is 8½. As the Damper on Type SRD units is controlled by three peripheral screws, each screw must be given the required number of turns.

TESTING PROCEDURE:

SQUARE ADJUSTABLE:

With an Alnor Velometer with a #2230 jet place the jet on the flanged edge of the diffuser blade. Get the highest reading by rotating the tube slightly. Take similar readings at various points on the diffuser and find the arithmetic average of all the readings. This average is the jet velocity in FPM. To calculate the air volume use the following formula:

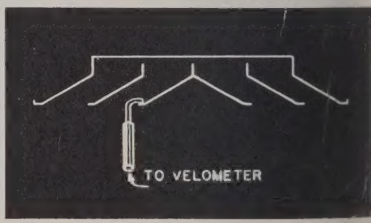


CFM = EA x V
CFM = cubic feet per minute
EA = effective area square feet
V = jet velocity FPM

Use the Table of Effective Areas below to determine the CFM delivered.

MULTI PATTERN

With an Alnor Velometer with a #2230 jet place the jet on the flanged edge of the diffuser blade. Get the highest reading by rotating the tube slightly. Take similar readings at various points on the diffuser and find the arithmetic average of all the readings. This average is the jet velocity in FPM. To calculate the air volume, use the following formula:



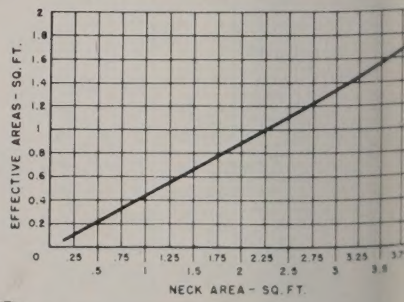
CFM = EA x V
CFM = cubic feet per minute
EA = effective area square feet
V = jet velocity FPM

Use the Chart of Effective Areas to determine total volume. The Effective Area on the MP diffusers is obtained by using the Chart #13 below.

TABLE OF EFFECTIVE AREAS

NO.	NECK DIA	NECK AREA SQ FT	DIFFUSER OPENING-IN.					
			H	FLAT	H	HALF	H	FULL
6	6	.196	0	.090	3/4	.125	3/4	.160
8	8	.348	0	.150	3/4	.201	1 1/2	.252
10	10	.545	0	.258	3/4	.382	1 1/2	.480
12	12	.785	0	.380	7/8	.583	1 3/4	.740
14	14	1.069	0	.402	1 1/2	.760	3	.924
16	16	1.396	0	.594	1 1/2	.980	3	1.012

CHART OF EFFECTIVE AREAS



FIELD MEASUREMENTS

PROCEDURE FOR TESTING

Using an Alnor Velometer (Alnor Instrument Company) with a #2230 Jet, place the jet on the flanged edge of the diffuser blade. Get the highest reading by rotating the tube slightly. Take similar readings at various points on the diffuser and fine the arithmetic average of all readings. This average is the jet velocity in FPM.

Calculate the air volume delivered through the diffuser with the aid of the following formula.

CFM = EA x V

CFM = Cubic Feet per minute

EA = Effective area, sq. ft.

V = Jet velocity, feet per minute

Effective areas of Types R and V diffusers in various positions are shown on charts #6 and #7 below. The "H" figure, in inches, indicates the amount of opening for each position. (See sketch above).

Another method of determining the volume of the air is by using Chart #2 Take the jet velocity on the right-hand side of the chart. follow through to the left, until this line crosses the heavy line corresponding to the diffuser size, then follow up vertically to get the desired volume of air.

However, remember that the volume indicated is for half-opening.

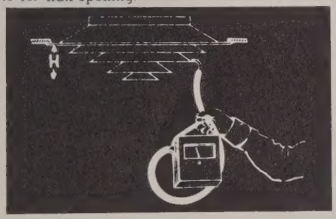


TABLE 1

TYPE **R**

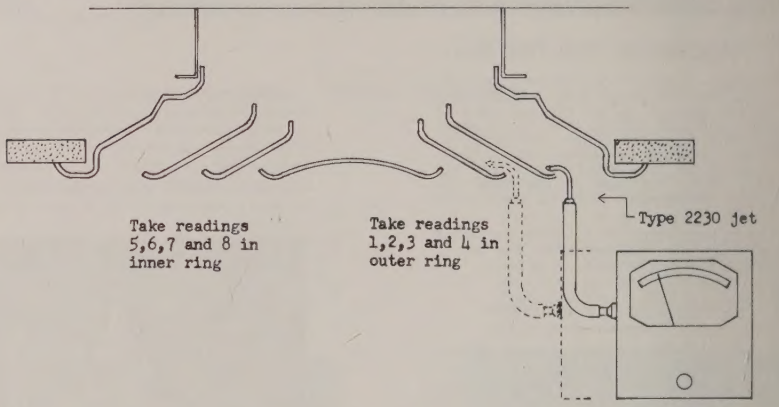
SIZE	H	EA	H	EA	H	EA	H	EA	H	EA
6	0	.088	½	.108	1	.117	1½	.147	2	.166
8	0	.151	½	.192	1	.217	1½	.262	2	.296
10	0	.245	½	.300	1	.358	1½	.410	2	.464
12	0	.353	¾	.433	1¼	.520	1⅝	.588	2¼	.677
14	0	.480	⅞	.587	1½	.680	2¼	.800	3	.908
16	0	.629	⅞	.770	1¾	.885	2⅝	1.04	3½	1.18
18	0	.795	1⅛	.972	2¼	1.07	3⅛	1.32	4½	1.50
20	0	.982	1⅛	1.20	2¼	1.37	3⅛	1.63	4½	1.85
22	0	1.19	1¼	1.45	2¼	1.71	3⅛	1.98	4½	2.25
24	0	1.41	1⅜	1.73	2⅝	2.18	3½	2.36	4¾	2.67
30	0	2.20	1⅜	2.70	2½	3.20	3¾	3.68	5	4.15

TABLE 2

TYPE **V**

SIZE	H	EA	H	EA	H	EA	H	EA	H	EA
6	0	.112	½	.133	1	.165	1½	.188	2	.222
8	0	.199	½	.238	1	.295	1¾	.335	2	.394
10	0	.311	½	.371	1	.464	1½	.524	2	.615
12	0	.447	⅜	.533	1⅛	.666	1¾	.752	2¼	.888
14	0	.610	¾	.725	1½	.902	2¼	1.12	3	1.21
16	0	.795	⅞	.948	1¾	1.18	2⅝	1.34	3½	1.58
18	0	1.01	1⅛	1.20	2¼	1.50	3⅛	1.69	4½	1.99
20	0	1.24	1⅛	1.48	2¼	1.85	3⅛	2.09	4½	2.46
22	0	1.51	1¼	1.80	2⅝	2.24	3⅛	2.54	4½	2.98
24	0	1.79	1¼	2.24	2⅝	2.67	3½	3.02	4¾	3.54
30	6	2.78	1⅜	3.33	2½	4.05	3¾	4.70	5	5.54

TESTING AEROFUSE DIFFUSERS



TUTTLE & BAILEY
AEROFUSE EFFECTIVE AREA FACTORS IN SQ. FT.

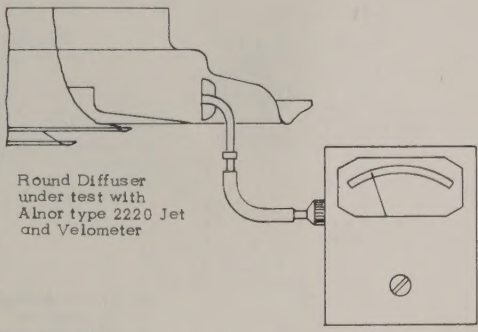
Diffuser Size	PA	PS	PF	PR	PH	PLF	D	ES	S
6"	.148	.173	.133	----	.066	----	.135	.145	.072
8"	.265	.310	.238	.166	.119	----	.232	.290	.121
10"	.410	.478	.368	.226	.184	.191	.400	.451	.183
12"	.593	.690	.532	.324	.266	.277	.570	.610	.238
14"	.810	.950	.728	.483	.364	.378	----	----	----
15"	----	----	----	----	----	----	.900	.940	.360
16"	1.06	1.23	.950	.596	.475	.495	----	----	----
18"	1.34	1.56	1.20	.686	.600	.625	----	1.43	.573
20"	1.65	1.92	1.48	.945	.740	.770	----	----	----
21"	----	----	----	----	----	----	----	----	.816
23"	----	----	----	----	----	----	----	2.28	----
24"	2.38	2.78	2.14	1.34	1.07	1.11	----	----	----
27"	----	----	----	----	----	----	----	3.60	1.21
30"	3.70	4.33	3.33	2.09	----	----	----	----	----
33"	----	----	----	----	----	----	----	5.50	1.95
36"	5.35	6.20	4.80	3.05	----	----	----	----	----
38"	----	----	----	----	----	----	----	----	2.92

INSTRUCTIONS: Connect the "Alnor" type 2230 jet to the Velometer as shown. Divide the periphery of the diffuser into four equal parts and take readings in the outer two air passages in each part, by hanging the 2230 jet over the upper edge of the diffuser ring. Rotate the jet slightly in the horizontal plane and retain the highest Velometer reading. Average the eight readings obtained and multiply this average by the effective area factor in table 3 which will yield cubic feet per minute. The effective area in the table for PA Diffusers assumes the air pattern to be in maximum horizontal position.

TESTING CARNES DIFFUSERS

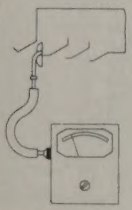
"K" FACTORS

DIFFUSER MODEL					
E	EJ	ER	EI	QSL	EH
.10			.10		
.16	.16		.13		.05
.28	.28	.26	.15	.18	.10
.45	.45	.27	.28	.39	.18
.63	.63	.40	.42	.54	.31
.86	.86	.50	.55	.73	.40
1.14	1.14	.60	.70	.92	.48
1.38	1.38	.76	.83		.57
1.74	1.74	.98	.97		.73
2.61	2.61	1.60	1.24		
3.45	3.45	2.60	1.35		
4.21	4.21	3.35	1.65		
5.59	5.59		2.00		



Round Diffuser under test with Alnor type 2220 Jet and Velometer

INSTRUCTIONS: Locate the Alnor type 2220 Jet opening slightly above the outer periphery of No. 1 cone facing squarely into the air stream as illustrated. No. 1 cone is the largest of the three center cones and closest to the ceiling plate. Average at least six equally spaced Velometer readings. From the table select the proper "K" Factor from the above table for size and model of the diffuser, multiply the K factor by the average velocity to obtain the air volume in CFM.



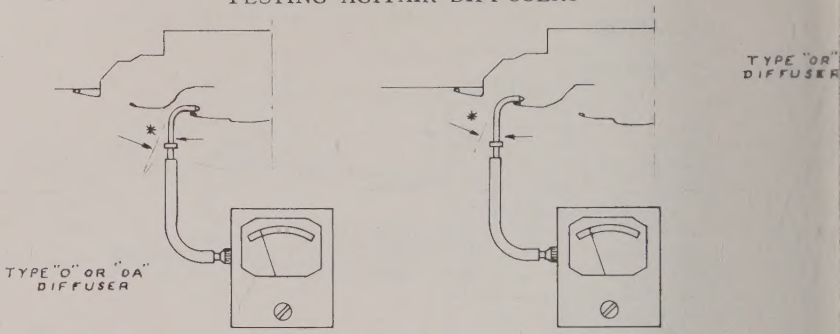
MODEL SFS
AND
MODEL SFR

SAMPLING PROCEDURE

1. Locate the opening of the Velometer nozzle immediately above the outer lip of the several louvers.
2. Measure the velocity at a number of positions along the central portions of these edges to within two inches from the end.
3. Multiply the average of these readings by the "K" factor shown below, and this will give the CFM delivered from the diffuser. The sampling method and "K" factor are the same for the Model SFS and Model SFR.

Model	Size	K	Model	Size	K	Model	Size	K
SFS	8 x 8	.24	SFS-2	8 x 8	.24	SFS-1	8 x 8	.18
SFS	12 x 12	.45	SFS-2	12 x 12	.45	SFS-1	12 x 12	.39
SFS	16 x 16	.74	SFS-2	16 x 16	.81	SFS-1	16 x 16	.65
SFS	20 x 20	1.12	SFS-2	20 x 20	1.24	SFS-1	20 x 20	1.03
SFS	8 x 12	.32						
SFS	8 x 16	.41	SFS-2S	8 x 12	.32	SFS-1S	8 x 12	.23
SFS	8 x 20	.50	SFS-2S	8 x 16	.41	SFS-1S	8 x 16	.33
SFS	12 x 16	.59	SFS-2S	8 x 20	.51	SFS-1S	8 x 20	.51
SFS	12 x 20	.71	SFS-2S	12 x 16	.60	SFS-1S	12 x 16	.53
SFS	16 x 20	.92	SFS-2S	12 x 20	.75	SFS-1S	12 x 20	.72
			SFS-2S	16 x 20	1.00	SFS-1S	16 x 20	.95
SFS-3	8 x 8	.20						
SFS-3	12 x 12	.41	SFS-2L	8 x 12	.31	SFS-1L	8 x 12	.23
SFS-3	16 x 16	.71	SFS-2L	8 x 16	.41	SFS-1L	8 x 16	.33
SFS-3	20 x 20	1.09	SFS-2L	8 x 20	.51	SFS-1L	8 x 20	.51
			SFS-2L	12 x 16	.60	SFS-1L	12 x 16	.53
SFS-2C	8 x 8	.20	SFS-2L	12 x 20	.75	SFS-1L	12 x 20	.72
SFS-2C	12 x 12	.39	SFS-2L	16 x 20	1.00	SFS-1L	16 x 20	.95
SFS-2C	16 x 16	.68						
SFS-2C	20 x 20	1.06						

TESTING AGITAIR DIFFUSERS



*Hold Jet Parallel To Diffuser or Angled A Few Degrees

Agitair Capacity Factors

Types "O" and "OA" Diffuser Size	"O"	"OA"			"OR"	Type "OR" Diffuser Size
		All Vanes Down	Two Vanes Horizontal	Four Vanes Horizontal		
6	0.134	0.222	0.222	0.222		
8	0.206	0.217	0.203	0.196	0.134	8"-5½"
10	0.316	0.355	0.349	0.339	0.219	10"-6½"
12	0.438	0.515	0.500	0.480	0.293	12"-8"
14	0.524	0.827	0.779	0.741	0.392	14"-9¼"
16	0.670	0.910	0.897	0.870	0.535	16"-10½"
18	0.850	1. 15	1. 13	1. 10	0.660	18"-12"
20	1. 05	1. 42	1. 40	1. 35	0.822	20"-13¼"
24	1. 51	2. 04	2. 01	1. 95	1. 17	24"-16"
28	1. 77	2. 40	2. 36	2. 29	1. 62	28"-18½"
32	2. 68	3. 63	3. 58	3. 46	2. 14	32"-21"

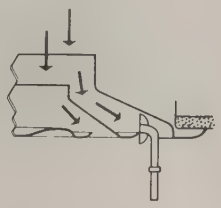
INSTRUCTIONS: Connect the "Alnor" type 2230 jet to the Velometer as shown. Place the flat tip of the 2230 on the edge of the spinning being careful to hold the axis of the jet either parallel to the centerline of the diffuser or tilted slightly as indicated. Take four to eight readings at equally spaced locations around the perimeter of the indicated spinning and average the readings to obtain the cubic feet per minute of air flow multiply the average velocity by the appropriate capacity factor taken from table.

TESTING VENTURI-FLO DIFFUSERS

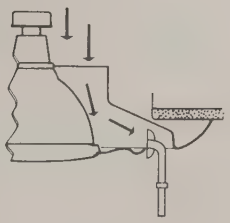
Instructions To determine the volume of air discharged, use the Alnor Velometer and Type 2220 Jet as illustrated. The shaft of the jet should be verticle and the bottom of the jet opening level with the top of the outer lip or cone. On the combination diffusers, exhaust may be measured with the same Velometer and 2220 Jet.

For exhaust measurements hold the jet as shown, measuring at the inner lip. Average at least six Velometer readings taken around the periphery of the diffuser. Multiply the average by the factors shown in the table below.

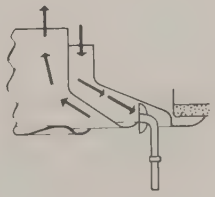
SIZE	MODEL JR & JS (Supply Only)	MODEL JRL & JSL (Supply Only)	MODEL JRC & JSC Exhaust	MODEL JRC & JSC Supply
[illegible]	0 14			
816	0 26	0.17	15	0 13
1020	0 42	0.30	22	0 20
1224	0 59	0 41	31	0 35
1428	0 81	0 48	42	0 41
1734	1 20	0 90	.62	0 84
2040	1 90	- - -	.86	1 50
2448	2 70	- -	1 20	2 50
2856	3 90	- - -	1 60	4 00
3264	5.00	- —	2 10	5 40



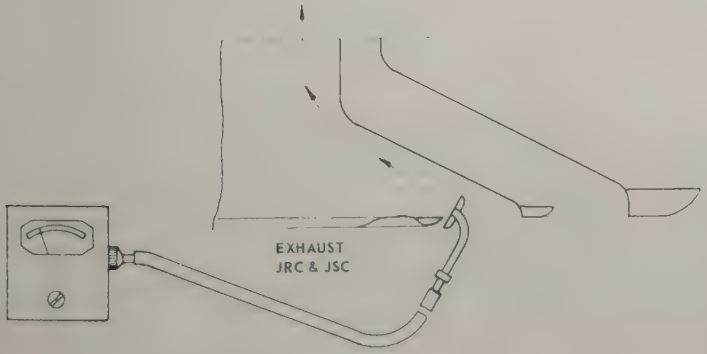
Model JR & JS
(Supply only)



Model JRL & JSL
(Supply only)



Model JRC & JSC
(On supply)



TESTING DIFFUSERS UNI-FLO AND LINE-O-FLO

Instructions The Alnor Velometer Jet No. 2220 should be held vertically against the outside edge of the molding which holds the diffuser plate design.

Take one Velometer reading in each direction and average before applying flow factor shown below. This means the average of four Velometer readings for the square diffuser with full 360° air pattern, three readings for three-way pattern, two readings for two-way pattern and one reading where the air is discharged in only one direction. Volume in CFM = Average velocity X Factor.

Square and Rectangular Diffusers

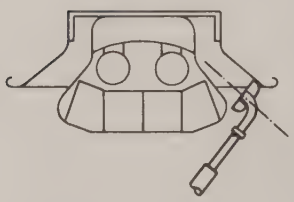
VELOMETER FLOW FACTORS

Square Diffusers

Air Pattern	Model 612		Model 816		Model 1020		Model 1224	
	Circular Plate	Geometric Plate	Circular Plate	Geometric Plate	Circular Plate	Geometric Plate	Circular Plate	Geometric Plate
360°	28	.27	49	47	75	65	99	98
3-way	23	22	43	39	63	55	86	81
2-way opposite	18	17	36	34	57	45	71	68
2-way corner	16	15	31	30	45	40	63	60
1-way	10	.09	20	19	29	23	39	38

Rectangular Diffusers

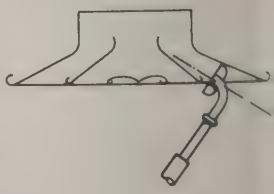
Air Pattern	Model 24 x 12	
	Circular	Geometric
360°	.63	.61
3-way (Short Baffle)	59	51
2-way (Opposite)	53	53
3-way (Long Baffle)	38	38
2 way Corner	32	31
1-way	.26	.25



CFM FACTOR

To determine the volume of air discharged from the Model LS and Model LL Line-o-Flo ceiling diffusers, the Alnor Velometer may be used with jet #2220 as shown above.

In order to properly center the jet on the diffusers, it may be necessary to tilt the jet at an angle.



Supply Throat Velocities in FPM

MODEL LL

(Based on net area in neck of light unit)

CFM	Throat Velocities	CFM	Throat Velocities
50	60	275	330
75	90	300	360
100	120	350	420
125	150	400	480
150	180	450	540
175	210	500	600
200	240	550	660
225	270	600	720
250	300	650	780

Before any tests are made, the Line-o-Flo dampers must be adjusted to provide a balanced air distribution with the velocities substantially equal on both sides and down the full length of the unit. The average Velometer reading obtained from measurements taken along both sides may then be multiplied by the following factor to obtain the volume of air discharged.

Model LS: Q (CFM = 1.25) x average velometer reading.

Model LL: Q (CFM = 0.81) x average velometer reading.

Supply Throat Velocities in F

MODEL LS

CFM	Throat Velocities	CFM	Th Vel
50	25	275	
75	38	300	
100	50	350	
125	63	400	
150	75	450	
175	88	500	
200	100	550	
225	113	600	
250	125	650	

Determining Air Flow From Titus Outlets and Intakes

I Sidewall Supply Outlets

Use "Alnor" type 2220 jet and hold opening as shown (Fig. 1) ½" from face of supply outlet (Titus Series 270). Take a number of readings in the centers of equal areas over the face of the grille. The average of these readings may then be used in the following formula to obtain cfm.

cfm=factor x core area x average velocity

See the table at right for factors. The core area must be in square feet.

FLOW RATE FACTORS		
	Deflection	Factor
Series 270	0°	0.82
	22½°	0.80
	45°	0.67
Series 230		0.45

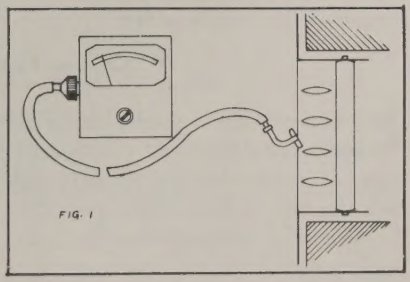


FIG. 1

II Sidewall Return Intakes

Use "Alnor" type 2225 jet and hold as shown (Fig. 2) flush with face of return (Titus Series 230).

Proceed exactly as described above.

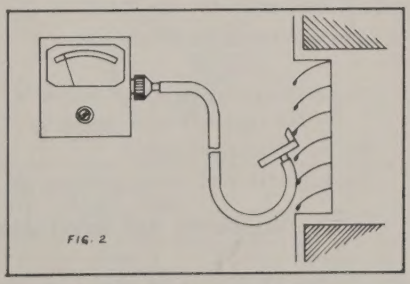


FIG. 2

III Perimeter Diffusers

Obtain the average velocity readings taken over the center of the two end openings in the top of the back slot and the front slot of the cover. Use the "Alnor" type 2220 jet.

cfm=factor x average velocity

FLOW RATE FACTORS	
P-125 Heating Position	0.132
P-125 Cooling Position	0.155
P-75	0.155

IV Linear Type Grilles – Series C-2500, C-2615

Use the "Alnor" type 2220 jet held flush to the face of the outlet over the slot. An average should be taken of readings obtained near the end and middle slots at various points across the face of the outlet.

cfm=C (Length x Measured Velocity)
C=Flow rate coefficients
length=Grille length in feet

FLOW RATE COEFFICIENTS		
Nominal Width, In.	C-2500	C-2615
1½	0.041	0.036
2	0.060	0.055
2½	0.078	0.072
3	0.097	0.091
3½	0.116	0.109
4	0.133	0.125

V Ceiling Type Grilles – Series 200

Obtain an average velocity using the "Alnor" type 2220 jet to obtain readings at uniformly spaced positions over the face of the outlet. The 2220 jet should be centered over the trailing edge of a vane. The average of those readings may be used in the following formula to obtain cfm.

cfm=Average velocity x factor x vane length x vane opening
Where: Factor=0.00674
Vane length and vane opening are in inches. The vane opening being the sum of the perpendicular open distance between vanes.

Example: The average measured velocity of 500 fpm is obtained. The grille is 12" x 6" model 201 with 2 vane openings of 1/8" and 6 of 1/2". The air flow rate then equals:
500 x 0.00674 x 11.25 x 3.25 = 123 cfm

VI Square and Rectangular Air Diffusers – Series TMD

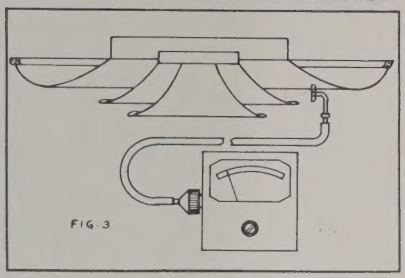
Place the 2220 jet at the leaving edge of a vane to obtain readings at various locations and average them. Use this average reading to obtain neck velocity. Neck velocity = 0.49 x (Average reading). To obtain cfm: cfm=neck velocity x neck area (in square feet).

VII Ceiling Diffusers – Model T-1

Use the "Alnor" type 2220 jet to obtain readings at the edge of the B cone as shown (Fig. 3). Obtain at least four readings equally spaced around the cone and average the readings.

To obtain cfm: cfm = Average Reading x Factor

AIR FLOW RATE FACTORS – T-1 Ceiling Diffusers		
Neck Diam. In.	Cones Down Factor	Cones Up Factor
6	0.15	0.11
8	0.22	0.17
10	0.38	0.29
12	0.50	0.39
14	0.79	0.60
16	0.82	0.62
18	1.07	0.81
20	1.38	1.02

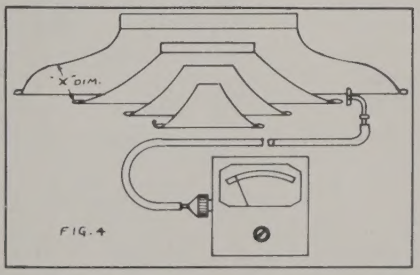


VIII Ceiling Diffusers – Model TM & TMA

Proceed as explained for model T-1 Diffusers. Note that dimension "X" must be considered in using factors. See Fig. 4 and the manufacturer's explanation which follows.

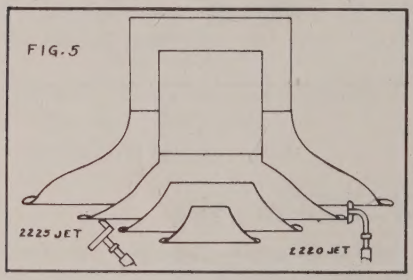
TM Diffusers – This dimension is fixed corresponding to one of three positions of the inner cones, down, centered, or up. The values of X are given in the table of flow rate factors.

TMA Diffusers – This dimension can be varied between the extremes of the TM diffusers. The flow rate factors given in the table are proportional to this dimension.

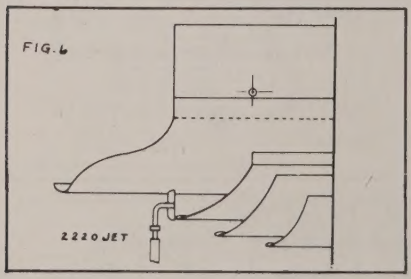


FLOW RATE FACTORS TM and TMA						
Neck Diam. In.	Cones Down		Cones Centered		Cones Up	
	X	Factor	X	Factor	X	Factor
6	1 5/16	0.15	15/16	0.14	5/8	0.12
8	1 3/4	0.28	1 1/4	0.25	13/16	0.21
10	2 3/16	0.43	1 5/8	0.39	1	0.33
12	2 5/8	0.62	1 15/16	0.56	1 3/16	0.48
14	3 1/16	0.85	2 1/4	0.77	1 3/8	0.65
16	3 1/2	1.10	2 9/16	1.00	1 5/8	0.86
18	3 15/16	1.40	2 7/8	1.27	1 13/16	1.05
20	4 3/8	1.74	3 3/16	1.57	2	1.28
24	5 1/4	2.50	3 11/16	2.20	2 3/8	1.75
30	6 5/8	3.90	4 13/16	3.15	3	2.55

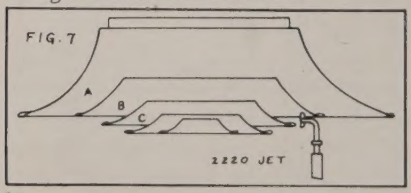
Use the "Alnor" type 2220 or 2225 as shown to obtain at least four readings equally spaced around the cones and average these readings.
To obtain cfm: cfm = Average Reading x Factor



Use the "Alnor" type 2220 jet as shown in Fig. 6. Proceed as in the TR diffuser using the factors listed below.



Use the "Alnor" type 2220 at the edge of cone C as shown in Fig. 7 and proceed as in the TR diffuser using factors listed below.



IX Model TR

TR FACTORS		
Neck Size In.	Factors 2220	2225
8	0.19	0.13
10	0.23	0.23
12	0.32	0.35
14	0.43	0.46
16	0.56	0.68
18	0.72	0.90
20	0.88	1.15
24	1.25	1.70

X Model TH

TH FACTORS		
Neck Diam. In.	Cones Down	Cones Up
6	0.09	0.07
8	0.14	0.11
10	0.21	0.16
12	0.28	0.23
14	0.37	0.29
16	0.46	0.36
18	0.57	0.44
20	0.68	0.53

XI Model TMS

Size	Factor
4	0.09
5	0.13
6	0.17
8	0.29
10	0.40
12	0.52
14	0.70
16	0.83
18	0.97